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SPECIFICATION FOR DENTAL INLAY CASTING WAX

(*First Revision*)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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October 1986

Indian Standard

SPECIFICATION FOR DENTAL INLAY CASTING WAX

(First Revision)

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Indian Standard

SPECIFICATION FOR
DENTAL INLAY CASTING WAX

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 27 January 1986, after the draft finalized by the Dental Materials Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was first published in 1973, substantially agreeing with ISO/R 1561-1970 'Dental inlay casting wax', issued by the International Organization for Standardization (ISO). This IS0 standard has been further revised as IS0 1561-1975 and the committee decided to align the existing Indian Standard with the international standard. In this revision, changes in the method for determination of flow have been incorporated.

0.3 This standard contains clauses 3.2 and 3.3 which permit the purchaser to use his option for selection to suit his requirements. Further, clauses 4.1 and 5.1 call for agreement between the purchaser and the supplier.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant placed retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes requirements and the methods of sampling and test for dental inlay casting wax.

1.1.1 The inlay casting wax is used in making patterns in the production of inlays and crowns. The wax consists essentially of natural waxes, resins and hydrocarbons of the paraffin series.

***Rules for rounding off numerical values (*revised*).**

2. TYPES AND CLASSES

2.1 The inlay wax is of two types, namely, direct technique wax intended primarily for intra-oral use, and indirect technique wax intended primarily for extra-oral use. Each type shall be classified as follows:

Type I — Direct technique wax:

- Class 1 — Sticks
- Class 2 — Cones

Type II — Indirect technique wax:

- Class 1 — Sticks
- Class 2 — Cones

3. REQUIREMENTS

3.1 Uniformity — The wax shall be uniform and free from foreign materials.

3.2 **Sizes** — The sizes of sticks and cones shall be as specified by the purchaser.

3.3 **Colour** — The colour of wax shall be as specified by the purchaser.

3.4 **Softening** — The wax shall soften, when heated, without becoming flaky. It shall not show laminations when formed into a working mass.

3.5 **Chipping** — The wax shall not show appreciable chipping or flaking when trimmed to a fine margin at 27 ± 2°C.

3.6 Flow — The samples of the wax, when submitted to the test described in **A-1,** shall give flow results complying with the requirements given below for the type of wax and different temperatures of testing:

	Flow at Test Temperature, Percent			
	30°C	37°C	40°C	45°C
Type I	—	1·0 (***Max***)	20 (***Max***)	70 ***to 90***
Type II	1·0 (***Max***)	—	50 (***Min***)	***70*** to 90

3.7 **Linear Thermal Expansion (for Type I Only)**

3.7.1 From 25·0 to 30·0°C, the linear thermal expansion shall be not more than 0·2 percent, when tested as detailed in A-2.

3.7.2 From 25·0 to 37·0°C, the linear thermal expansion shall be not more than 0·6 percent, when tested as detailed in A-2.

3.8 Residue — The melted wax, when vaporized at 500°C, shall leave no solid residue in excess of 0·10 percent of the original mass of the specimen when tested in accordance with A-3.

3.9 **Manufacturer's Instructions** — Instructions, including the method for softening and the working temperature, shall be supplied with each package of wax. In addition, data showing the thermal expansion of Type I wax from 25 to 30°C and from 25 to 37°C shall accompany each package of that wax.

4. PACKING AND MARKING

4.1 Packing — The material shall be packed as agreed to between the purchaser and the supplier.

4.2 **Marking** — Each container shall be marked with the following information:

a) Lot numbers or code to identify from the manufacturer's records, the particular lot or batch of wax;

b) Date of manufacture (year and month), either as a separate item, or as a part of the lot number;

c) Net mass in g of the contents; and

d) The type and class of wax, as designated in 2.

4.2.1 The containers may also be marked with the ISI Certification Mark.

NOTE — The use of the IS1 Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The IS1 Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. IS1 marked products are also continuously checked by IS1 for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the IS1 Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5. SAMPLING

5.1 The method of preparing samples of the material and the criteria for conformity shall be as given in Appendix B.

APPENDIX A

(Clauses 3.~6, 3.7 *and 3.8*)

METHODS OF TEST FOR DENTAL INLAY CASTING WAX

A-l. DETERMINATION OF FLOW

A-l.1 Apparatus

A-1.1.1 *Metric Micrometer Caliper*

A-1.1.2 Flow Testing Instrument — The flow testing instrument (Fig. 1) consists of a metallic cylinder *A* a non-conducting shaft *B* and a brass plate C. The total mass in air of the three components is 2 000 g. The cylinder *A* shall be separated from the plate C on the shaft *B* by a minimum distance of 75 mm. The shaft shall be of hard rubber or of similar poor thermal conductor to avoid loss of heat due to conduction. The diameter of the brass plate which touches the test specimen shall be not less than 50 mm. The thickness of the plate shall not exceed 6·5 mm.

A-1.1.3 *Mould* — It consists of a stainless steel plate (Fig. 2) 6·0 mm thick, having flat parallel top and bottom surfaces, and containing four holes, each 10·0 mm in diameter. The axes of the holes shall be perpendicular to the surfaces of the plate. The sides of the holes should be finished smooth.

A-1.1.4 *Metal Pouring Pan* — As shown in Fig. 3.

A-1.2 **Preparation of Test Specimens** — Break some quantity of wax into pieces and place in the metal pouring pan. Place the pan on a surface which is 130 mm below a 250 W infra-red lamp. Allow the wax, while being stirred, to reach a temperature of 75 ± 5°C and maintain at this temperature until the sample is melted throughout. Use a thermometer to measure the temperature. Then pour the melted wax into the mould that has been lubricated with a silicone grease whose melting point is higher than 80°C. Pre-heat the mould to 55 ± 5°C and place on a smooth glass slab (150 mm long, 75 mm wide and 20 mm thick) also pre-heated to the same temperature. As the wax solidifies and a shrinkage void appears, add more of the melted wax. When the wax has lost its mirror-like surface, place on top of the mould a smooth flat tin-foil or aluminium-foil covered glass plate preheated to 55 ± 5°C. Apply a load of 90 N (approx 9 kgf) to the top of the foil-covered glass plate for 30 minutes. Then remove the load and the glass plate and trim away the excess wax by drawing a straight-edged metal scraper across the mould thereby trimming the specimen flush with the surface. Remove the mould from the glass plate by gently tapping the side of the mould. Remove the specimens of wax from the mould by chilling’ in water at 10°C and then store at 27 ± 2°C for 24 hours before testing.

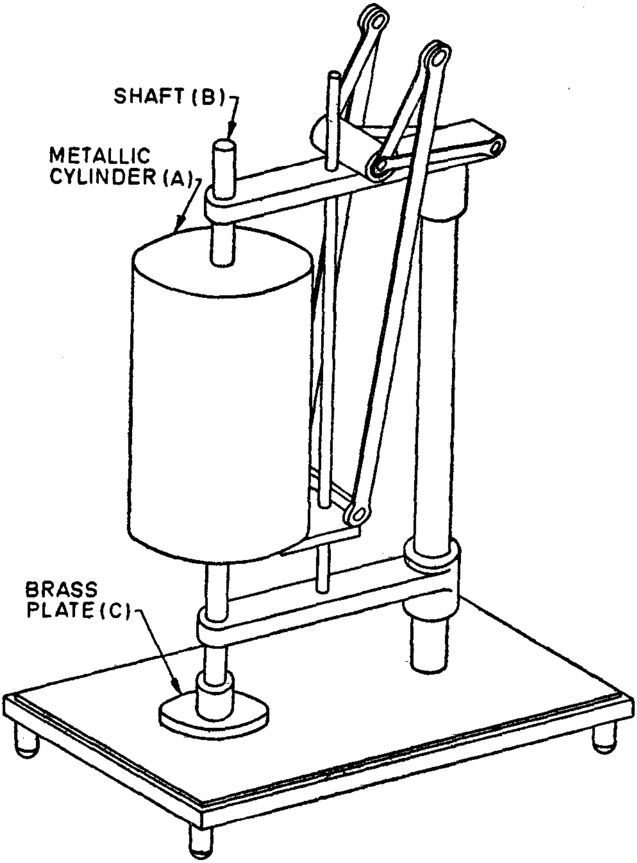


FIG. 1 FLOW TESTING INSTRUMENT

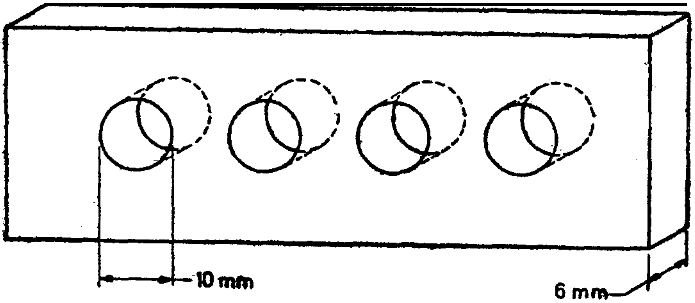


FIG. 2 MOULD FOR FORMING FLOW SPECIMENS

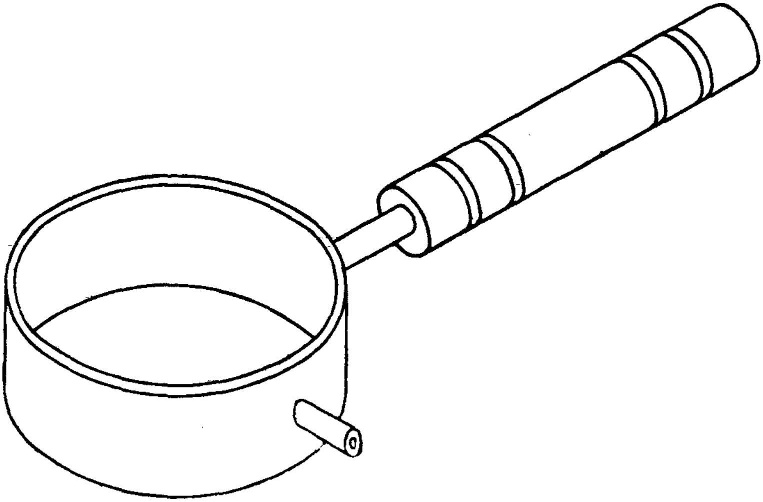


FIG. 3 METAL POURING PAN

A-1.3 Procedure — Measure the initial length of the specimen at 27 ± 2°C using a metric micrometer caliper. Make four measurements around the circumference and one measurement on the centre of the specimen. Record the average of the measurements to the nearest 0·005 mm. Place the specimen and the flow testing instrument in a water-bath and keep at the testing temperature for 20 minutes prior to testing. Control the temperature of the bath to within 0·1°C of the required temperature (use a calibrated thermometer for determining the temperature). Provide for agitation in the water-bath by means of a mechanical stirrer. Place a thin sheet of waterproof cellophane between the instrument and each end of the specimen. The bottom of the specimen shall be 50 mm below the surface of the water in the bath. Apply a constant axial load of 20 N (approx 2 kgf) to the specimen for 10 minutes, after which remove the specimen and cool in air to 27 ± 2°C. Strip off the cellophane and determine the final length in the same manner as the original length.

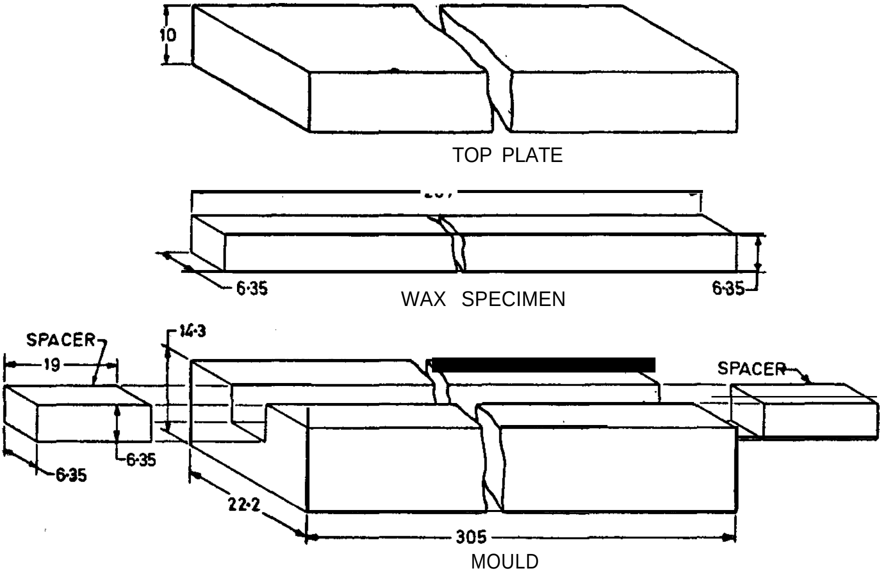
A-1.4 Expression of Results — Calculate flow, as evidenced by the change in length, as a percentage of the initial length. The value for flow at any temperature shall be the mean value for two specimens and shall be reported to the nearest 0·1 percent.

A-2. DETERMINATION OF LINEAR THERMAL EXPANSION

A-2.1 Apparatus

A-2.1.1 *Micrometer Microscope Comparator* — *or* an equivalent instrument of equal accuracy.

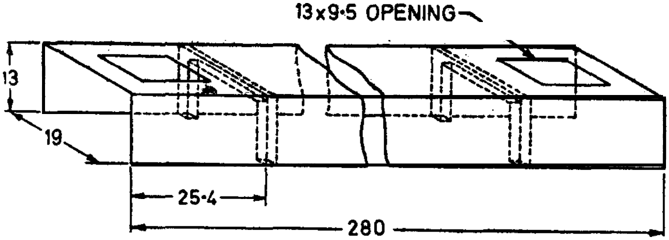
A-2.1.2 *Brass Mould* — 305 mm in length, having an opening of 6·35 x 6·35 mm running its full length, with spacers, 19 mm in length, at each end (see Fig. 4).



All dimensions in millimetres.

FIG. 4 MOULD FOR FORMING THERMAL EXPRESSION SPECIMEN

A-2.1.3 *Holder* — as shown in Fig. 5. It has openings at the top for viewing the reference marks for linear measurements. These openings shall be located at 6·35 mm from each end of the holder and shall be 9·5× 13 mm in size. The holder is so constructed that the wax specimen rides against only two narrowed sections, having 8 X 8 mm openings, located 25·4 mm from each end, to enable alignment with a minimum of restraint to the expansion during heating.



All dimensions in millimetres.

FIG. 5 HOLDER FOR THERMAL EXPRESSION SPECIMEN

A-2.2 Preparation of Test Specimens — Melt the wax as described in A-1.2 and pour into the brass mould, lubricated with a silicone grease whose melting point is higher than 80°C, until the mould is overfilled. Preheat the mould to 55 ± 5°C. As the wax solidifies and shrinkage occurs, add the liquefied wax. When the wax has lost its mirror-like surface, place on top of the overfilled mould a lubricated brass plate, preheated to 55 ± 5°C. Apply a load of 90 N (approx 9 kgf) to the top of the brass plate for 30 minutes. Remove the weight and the brass plate and trim away the excess wax until the specimen is flush with the top of the mould. The size of the specimen thus prepared will be approximately 267 x 6·35 x 6·35 mm and is suitable for use with a micrometer microscope comparator. Remove the specimen from the mould and embed in its surface, near each end, small metal pins having cross marks which serve as reference marks for subsequent linear measurements. After preparing the test specimens, store them at 27 ± 2°C for 24 hours before testing.

A-2.3 **Procedure** — Heat the specimens prepared in accordance with A-2.2 to three different temperatures and measure the distance between the reference marks at each temperature with micrometer microscope comparator. Place the specimen under the holder with openings for viewing the reference marks. Make an initial measurement in water after 20 minutes at 25·0 ± 0·1°C. Raise the temperature of the water-bath to 30·0 ± 0·1°C. Keep the specimen for 20 minutes at that temperature before measuring the distance between the marks. Carry out the same procedure at 37·0 ± 0·1°C. Make a repeat test starting at 25·0 ± 0·1°C on the same specimen.

A-2.4 **Expression of Results** — Using the measurement at 25·0 ± 0·1°C as zero, calculate the mean value of the two determinations at each temperature, round it off to the nearest 0·05 percent, and report it as the value for linear thermal expansion.

A-3. DETERMINATION OF NON-VOLATILE RESIDUE

A-3.1 Procedure — Place approximately 1 g of wax in a crucible previously conditioned to constant mass by repeated heating to 500°C and cooling to room temperature. Place the conditioned, tared and loaded crucible in a furnace at room temperature. Increase the temperature of the furnace to 500°C and maintain at this temperature for 1 hour. Remove the crucible from the furnace, place in a desiccator, allow to cool to room temperature and then weigh. Carry out a duplicate determination.

A-3.2 **Expression of Results** — Calculate the mean value of two determinations and report to the nearest 0·02 percent.

APPENDIX B

(Clause **5.1**)

SAMPLING OF DENTAL INLAY CASTING WAX

B-l. GENERAL REQUIREMENTS OF SAMPLING

B-1.0 In drawing, preparing, storing and handling test samples, the precautions and directions given in **B-l.1** to **B-l.7** shall be observed.

B-l.1 Samples shall not be taken in an exposed place.

B-l.2 The sampling instrument shall be clean and dry.

B-l.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

B-l.4 To draw a representative sample, the contents of each container selected for sampling shall be mixed as thoroughly as possible by suitable means.

B-l.5 The samples shall be placed in clean, dry, air-tight, glass or other suitable containers.

B-l.6 The sample containers shall be of such sizes that they are almost completely filled by the sample.

B-l.7 Each sample container shall be sealed air-tight with a suitable stopper after filling and marked with full details of sampling, the date of sampling and the year of manufacture of the material.

B-2. SCALE OF SAMPLING

B-2.1 Lot — All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared or known to consist of different batches of manufacture, the containers belonging to the same batch shall be grouped together and each such group shall constitute a separate lot.

B-2.1.1 Samples shall be tested from each lot for ascertaining conformity of the material to the requirements of the specification.

B-2.2 The number of containers (n) to be selected from the lot shall depend on the size of the lot (N) and shall be as given in Table 1.

B-3. TEST SAMPLES AND REFEREE SAMPLE

B-3.1 Preparation of Test Samples

B-3.1.1 Draw with an appropriate sampling instrument, a small portion of the material from different parts of each container selected

(*see* Table 1). The total quantity of the material drawn from each container shall be sufficient to conduct the tests for all the characteristics given under 3 and shall be not less than 250 g.

TABLE 1 **NUMBER** OF CONTAINERS TO BE SELECTED FOR SAMPLING

LOT SIZE N (1)	NO. OF CONTAINERS TO BE SELECTED n (2)
3 to 50	3
51 to 200	4
201 to 400	5
401 to 650	6
651 to 1 000	7

B-3.1.2 Thoroughly mix all portions of the material drawn from the same container. Out of these portions, equal quantities shall be taken from each selected container and shall be well mixed up together so as to form a composite sample weighing not less than 0·5 kg. This composite sample shall be divided into three equal parts, one for the purchaser, another for the supplier and the third for the referee.

B-3.2 **Referee Sample** — The referee sample shall consist of a composite sample marked for this purpose and shall bear the seals of the purchaser and the supplier. It shall be kept at a place agreed to between the purchaser and the supplier and shall be used in case of dispute between the two.

B-4. NUMBER OF TESTS

B-4.1 Tests for all the characteristics given in 3 shall be conducted on the composite sample.

B-5. CRITERIA FOR CONFORMITY

B-5.1 A lot shall be declared as conforming to this specification if the composite sample satisfies the requirements for each of the characteristics given in 3. If the requirements for any of the characteristics are not met, the lot shall be declared to have not satisfied the requirements of the specification.

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